B-layer/Thermal Barrier Integration

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Mechanics Session

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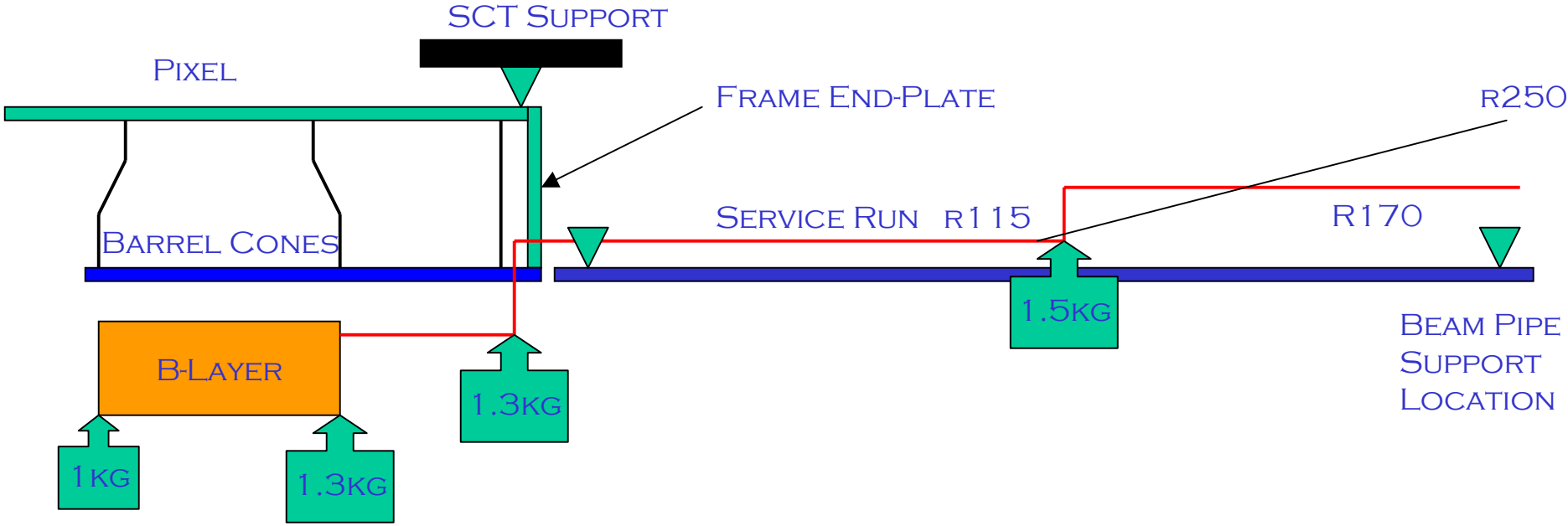
Reminders

- **Proposal to put permanent rails in detector**
  - Ramifications
  - Progress/areas for improvement
- **History of Thermal Barrier**
  - General problem
  - Known trouble with old solutions
  - Proposed integrated solution

B-Layer Installation

- **Updates on work in progress**
- **Requirements/Necessity**
  - Looking at beampipe design which does not require B-Layer removal for maintenance
  - Finite Detector Life-still a necessity
- **Access**
  - Short Opening Scenario little changed
- **Constraints**
  - Space limits-during Access remain the same
  - Alignment Grid increased
  - Thermal Barrier In forward SCT will allow us to support services and a rail

Permanent Rails



- Proposed to mount rail off of frame end stiffener and barrel support cones
- Services out one side
- Rail in SCT Forward--also permanent
- Support of services off of SCT Forward Thermal Barrier (via rail)
- Try to integrate B-Layer installation with B-Layer support

Ramification of Proposal

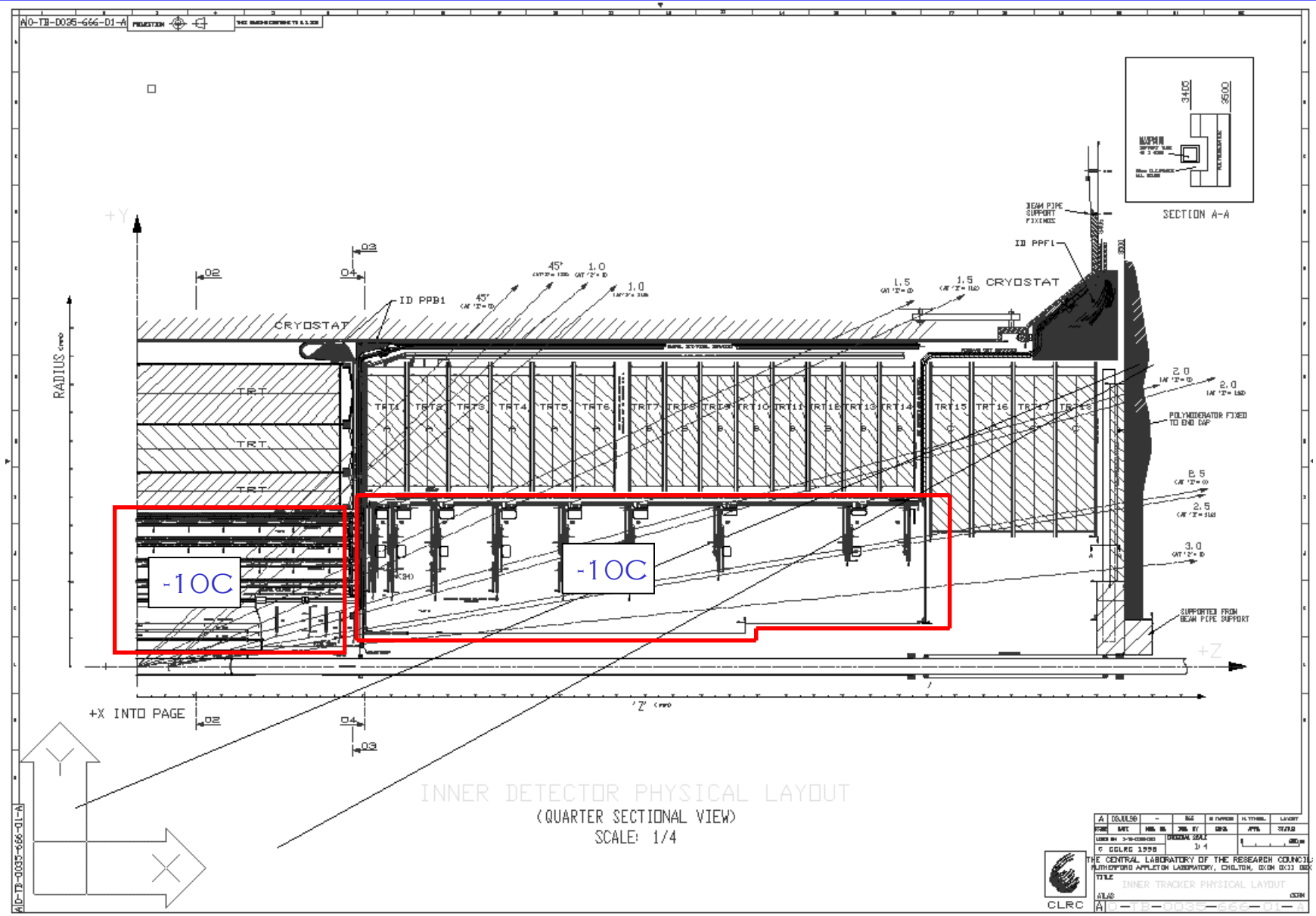
- Simplifies assembly of B-Layer, arguably, makes possible…
- Increased services on one side of detector and in center section
- Requires tighter integration with SCT Forward
- Neglected thermal barrier penetrations

Thermal Barrier Requirements

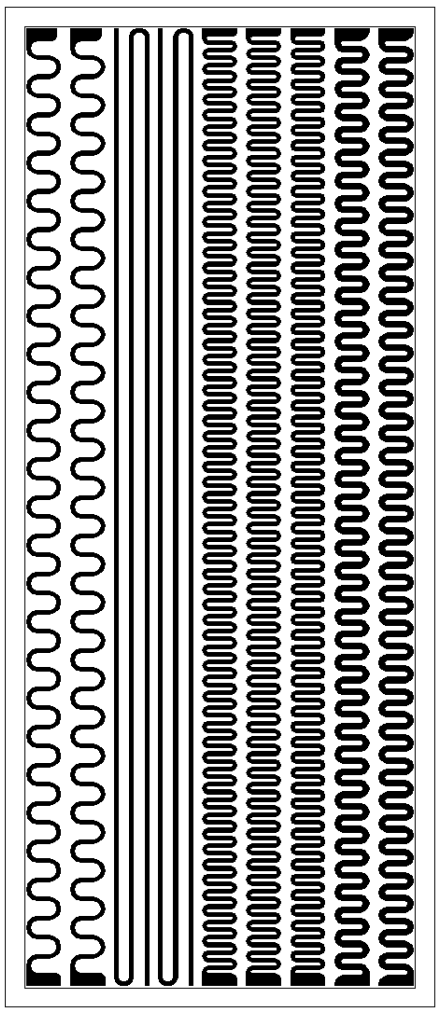
- The Volume for installing the B-Layer is filled with Cavern Air – Dewpoint of 13 Deg C
- Detector Volume is as low as -15 Deg C– Thermal Barrier must stand-off ~30 Deg C thermal gradient in minimal space
- Structure of Thermal Barrier minimized for X0
- No Condensation is allowed on any surface within the detector
- Design requires Knowledge of Installation and Removal Scenarios, Times and failure modes

These requirements lead to an active thermal barrier requiring heat input on the exterior surfaces to meet boundary conditions

Pixel Detector



Thermal Barrier Construction

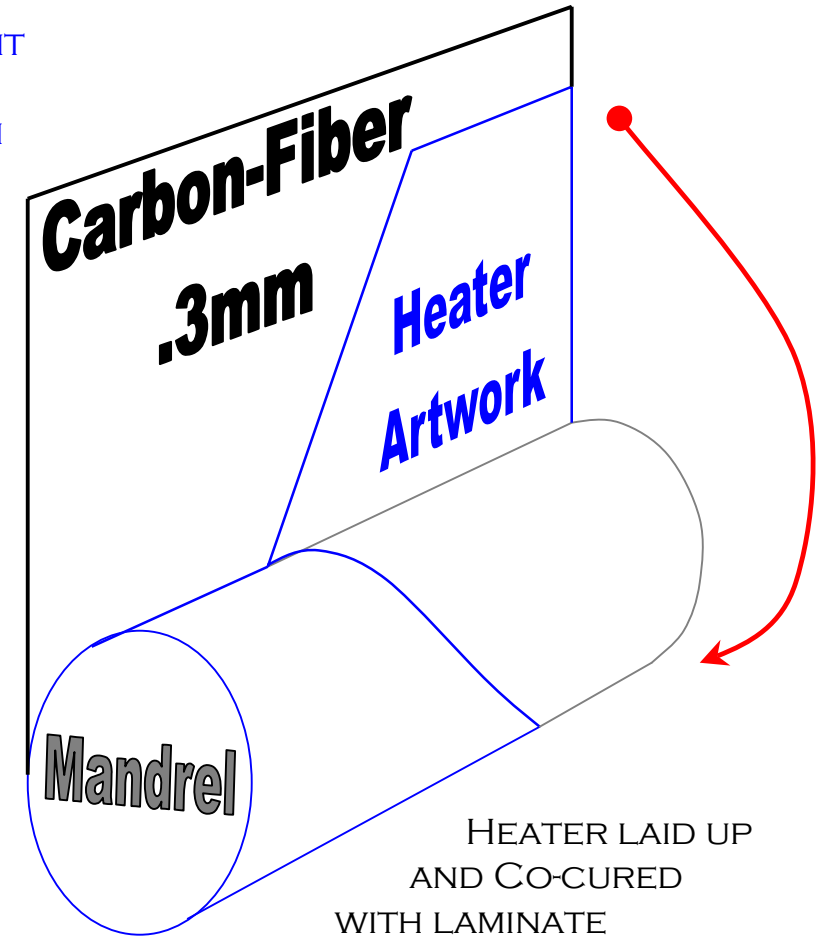


Test Artwork for current Limit testing. Left Sets have equivalent radiation lengths. Slightly more heat is required at penetrations and boundaries

Test program on:
Double-Sided Al-Kapton
20micron AL
50micron Kapton

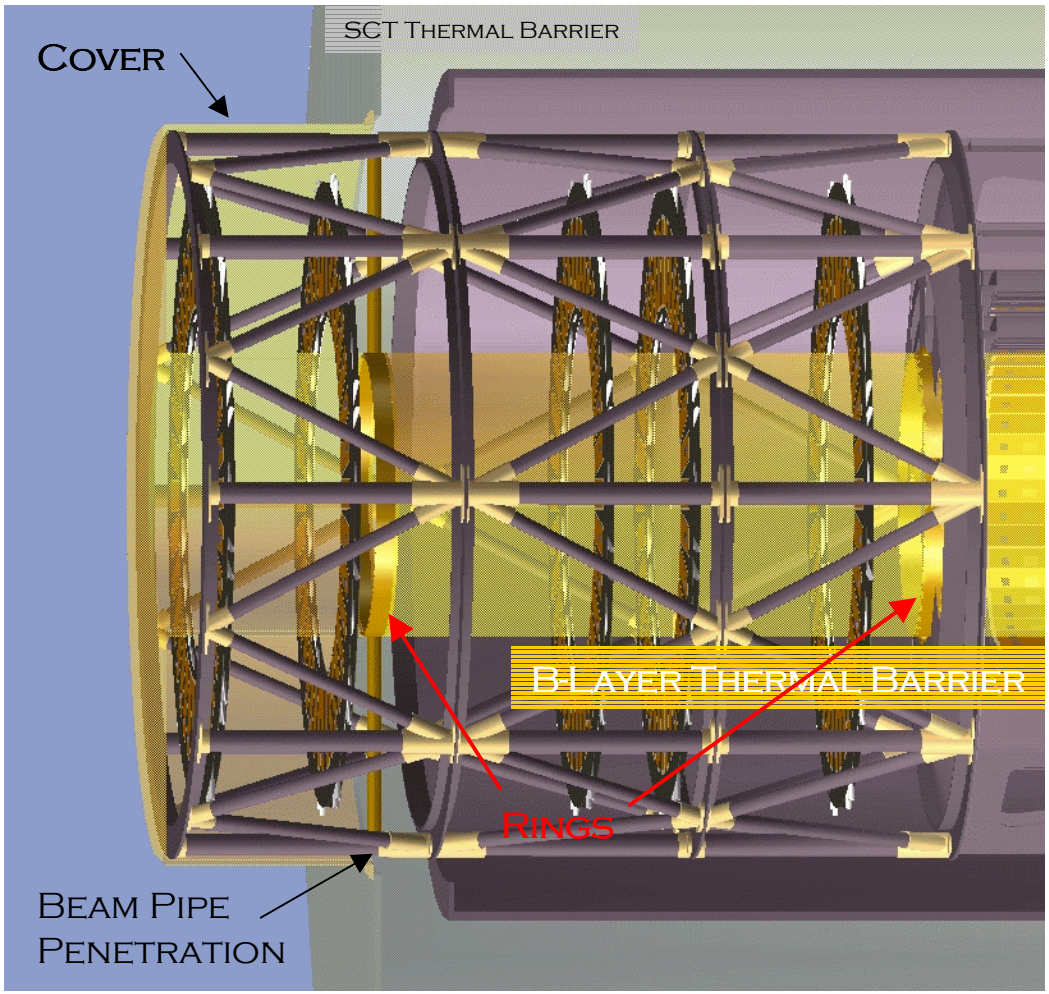
Heater patterns etched in one side

Design goal:
1-Amp / trace
2 traces / square cm
(traces have 5mm pitch)



Heater laid up and Co-cured with laminate

Heat Leaks/Penetrations

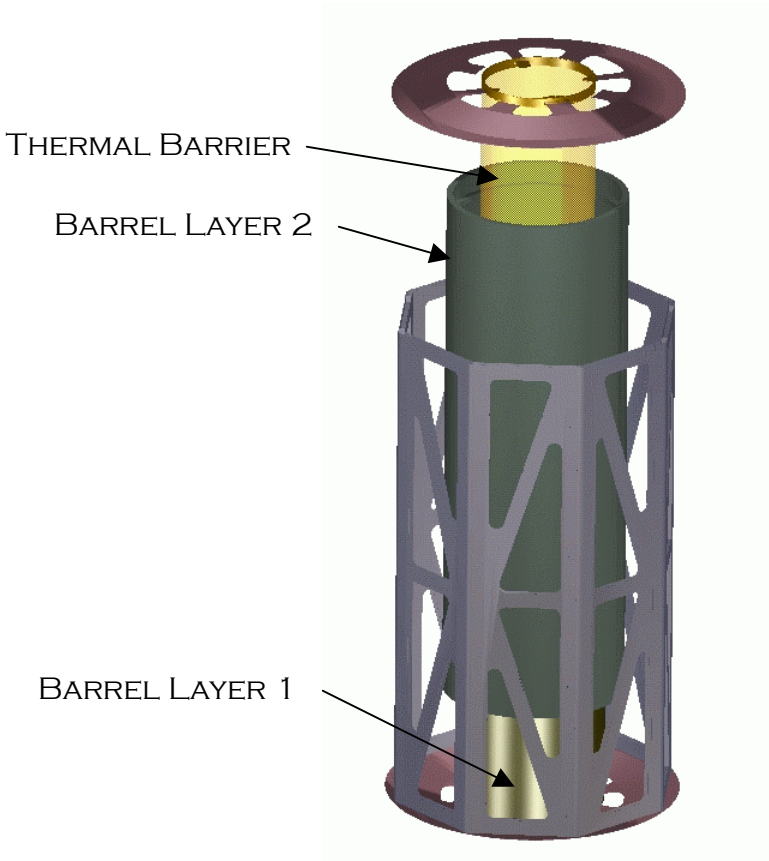


Note: this is an extremely old Illustration. It is used to here only to illustrate a problem

It is necessary to seal at every penetration. Where there is a penetration it required a ring to seal the cylinders to.

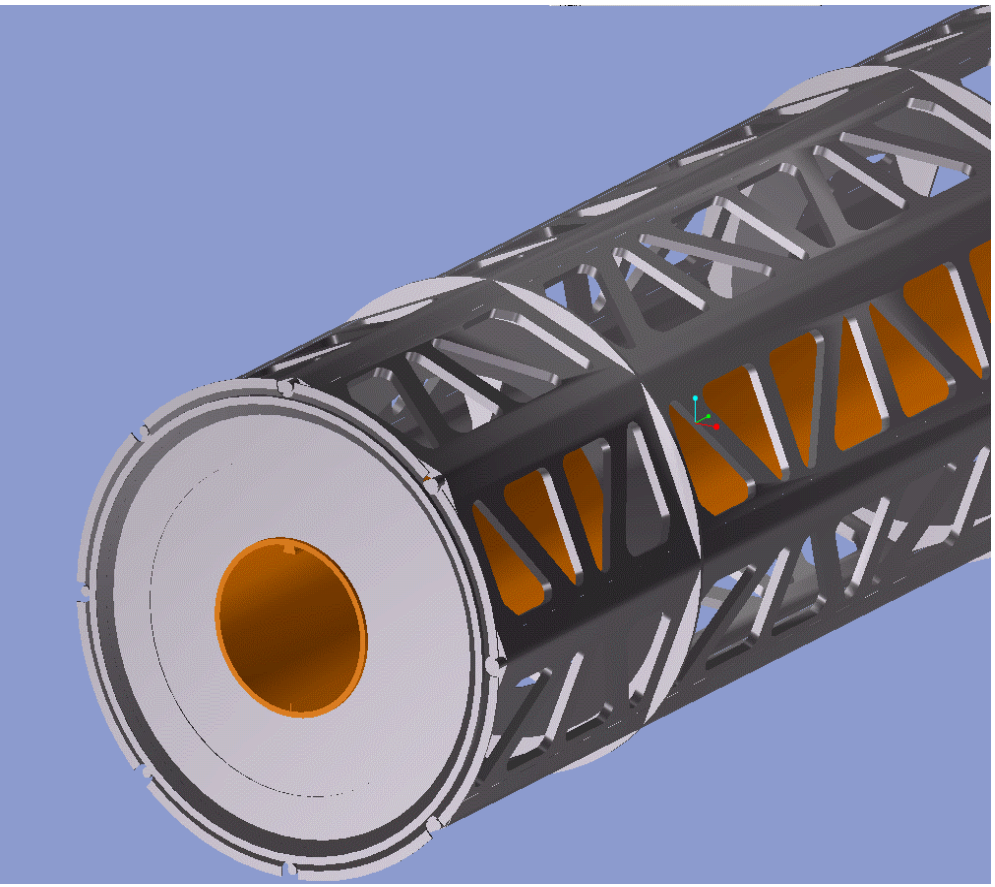
At every seal it is necessary to guarantee that no cold gas leaks as well as providing no thermally conductive path.

Nominal "Base-Line" Design



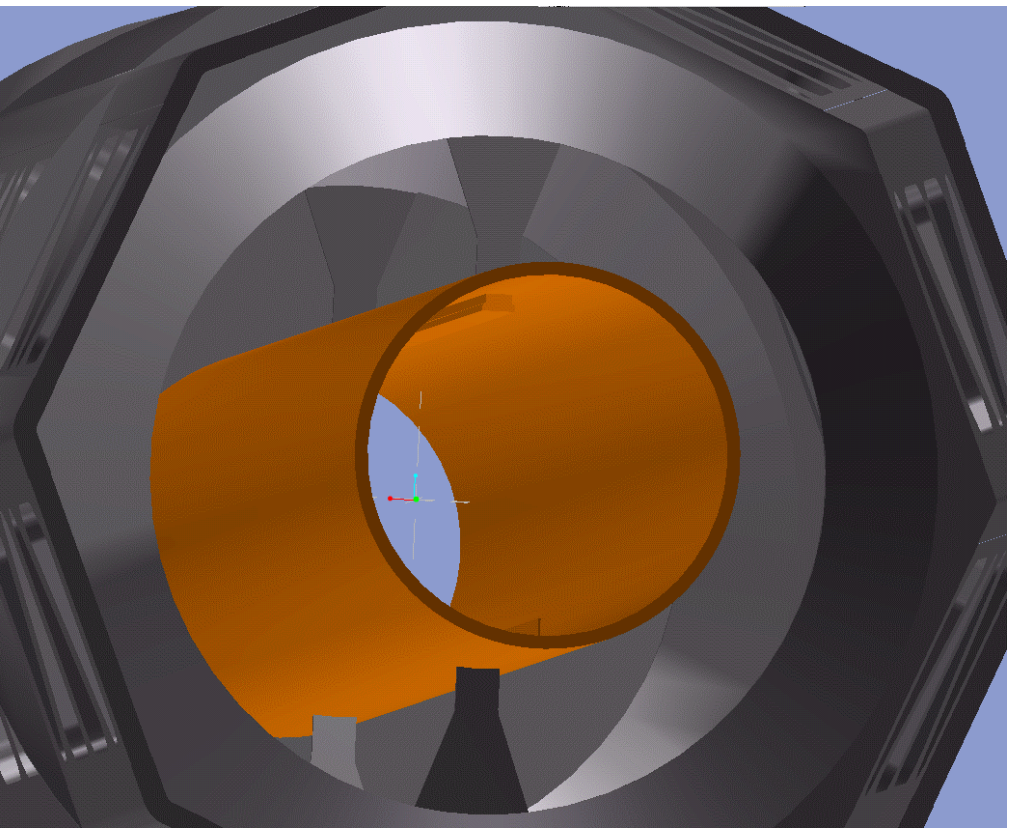
- Thermal barrier in three parts (Central + 2forward)
- Tied support fingers together with insulator/seal
- Potential for leaks next to beampipe and b-layer
- Needs structurally de-coupling seals

Additional Proposal



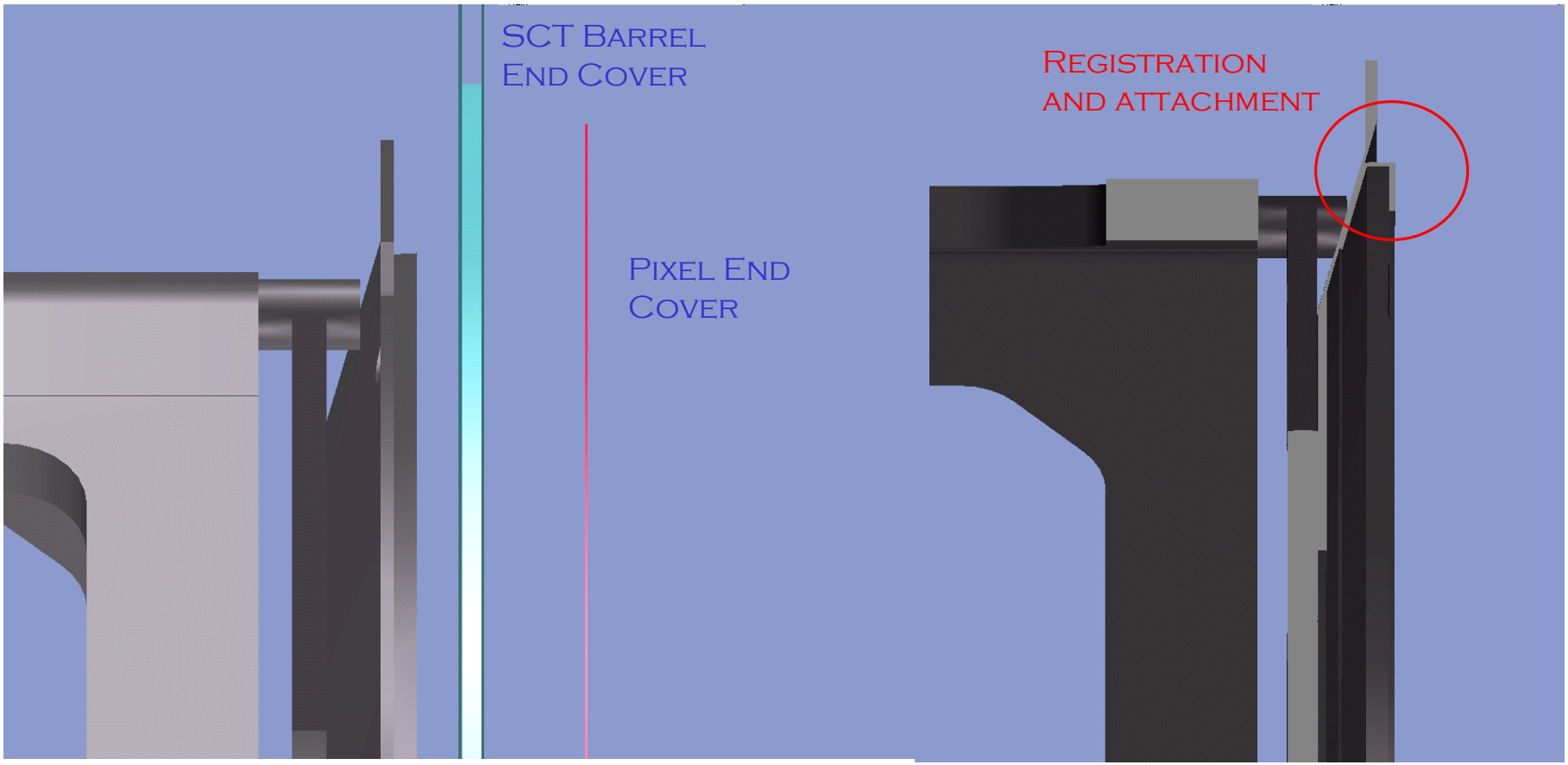
- Integrate Support rail into Thermal Barrier-Solves problem of thermal penetrations/interfacing
- Support Thermal Barrier from Frame Stiffener
- Make Frame Stiffener Inner Wall of thermal Barrier
- Provide tie points from support cone to exterior of Thermal barrier to locate b-layer
- Provide interface to Remainder of Barrel Thermal Barrier

Change of Support

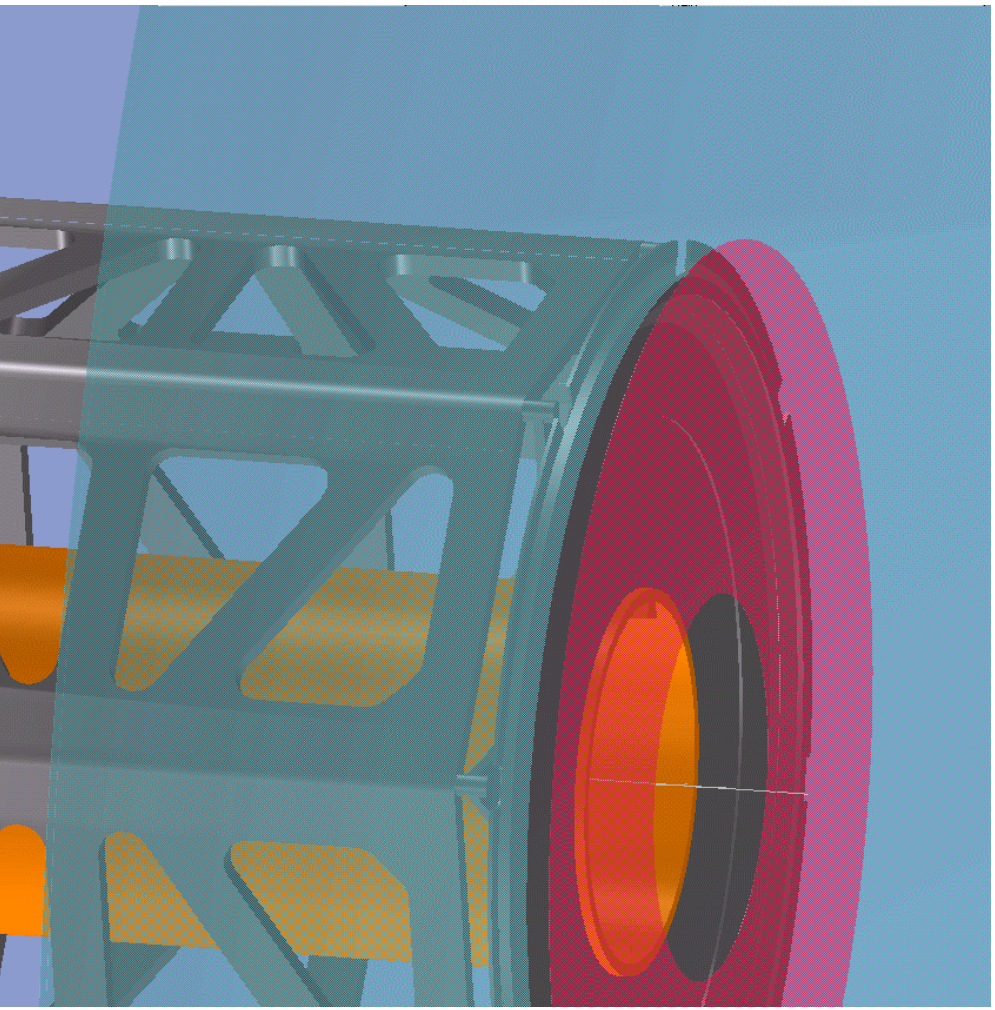


- Recommend changing B-layer support to vertical plane
- Hang from upper rail, get orientation from lower rail
- Fingers benefit in z-stiffness from z-stiffness of endplates
- Rail benefits from bending stiffness of thermal barrier
- Simplifies interface by avoiding penetrations

Detail of Barrel TB interface



Precise Parts



- Endcap of Barrel TB is Trapped only in z, radial motion is allowed
- Integration of thermal Barrier with Support allows for more well defined interface with external thermal barrier
- Due to space Constraints and interfaces/seals, thermal barriers were necessarily accurate structures

Discussion

- Sources of Error
- Z-Stiffness
- Pressure Variation
- Assembly tooling not included